

What is claimed is:

1. A method for evaluating the performance of an anion exchange resin, comprising the steps of:

5 measuring the inorganic carbonic acid concentration in the outlet water of an ion exchange resin vessel filled with at least an anion exchange resin; and

10 evaluating the performance of the anion exchange resin filled in said ion exchange resin vessel based on the obtained measurement value of the inorganic carbonic acid concentration in the outlet water.

2. A method according to claim 1, further comprising the steps of:

15 measuring the inorganic carbonic acid concentration in the inlet water of said ion exchange resin vessel; and

evaluating the performance of said anion exchange resin based on the inorganic carbonic acid concentrations of said outlet water and of said inlet water.

20 3. A method according to claim 1, wherein said inorganic carbonic acid concentration is continuously measured.

4. A method according to claim 1, wherein said inorganic carbonic  
25 acid concentration is intermittently measured.

5. A method according to claim 2, further comprising the steps of:

calculating an MTC (Mass Transfer Coefficient) of said anion exchange resin with respect to the inorganic carbonic acid from the measured values for the inorganic carbonic acid concentrations of the inlet water and of the outlet water of said ion exchange resin vessel; and

evaluating the performance of said anion exchange resin based on the obtained MTC.

6. A method according to claim 5, further comprising the steps of:

evaluating the degree of degradation of said anion exchange resin from said MTC; and

judging at least one of the replacement timing, lifetime, and throughput capacity for said anion exchange resin.

7. A method for evaluating the performance of an anion exchange resin filled in an ion exchange resin vessel, said method comprising the steps of:

providing a mini-column filled with at least the same anion exchange resin as the anion exchange resin in said ion exchange resin vessel, said anion exchange resin layer in said mini-column having a lower height than the height of said anion exchange resin layer filling said ion exchange resin vessel;

measuring the inorganic carbonic acid concentration of the outlet water of said mini-column by passing, from the inlet of said mini-column, a portion of the inlet water for said ion exchange resin vessel; and

5       evaluating the performance of the anion exchange resin filling said ion exchange resin vessel based on the obtained measurement value of the inorganic carbonic acid concentration in the outlet water of said mini-column.

10      8.     A method according to claim 7, further comprising the steps of:

measuring the inorganic carbonic acid concentration of the outlet water of said ion exchange resin vessel; and

15       evaluating the performance of the anion exchange resin in said ion exchange resin vessel based on both said measurement results and the inorganic carbonic acid concentration of the outlet water of said mini-column.

20      9.     A method according to claim 7, wherein the height of the layer of anion exchange resin filling said mini-column is equal to or lower than 1/2 of the height of the layer of the anion exchange resin filling said ion exchange resin vessel.

25      10.    A method for evaluating the performance of an anion exchange resin filled in an ion exchange resin vessel, said method comprising

the steps of:

providing a mini-column filled with at least the same anion exchange resin as the anion exchange resin in said ion exchange resin vessel, said anion exchange resin layer in said mini-column  
5 having a lower height than the height of said anion exchange resin layer filling said ion exchange resin vessel;

measuring inorganic carbonic acid concentrations of the inlet water and of the outlet water of said mini-column by passing, from the inlet of said mini-column, a portion of the inlet water for  
10 said ion exchange resin vessel; and

evaluating the performance of the anion exchange resin filling said ion exchange resin vessel based on the obtained measurement values of the inorganic carbonic acid concentrations of the inlet water and of the outlet water of said mini-column.

15 11. A method according to claim 10, further comprising the steps of:

measuring inorganic carbonic acid concentrations of the inlet water and of the outlet water of said ion exchange resin vessel;  
20 and

evaluating the performance of the anion exchange resin in said ion exchange resin vessel based on both the said measurement results and the inorganic carbonic acid concentrations of the inlet water and of the outlet water of said mini-column.

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12. A method according to claim 10, wherein the height of the layer of anion exchange resin filling said mini-column is equal to or lower than 1/2 of the height of the layer of the anion exchange resin filling said ion exchange resin vessel.

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13. A method according to claim 1, wherein said ion exchange resin vessel is a condensate water demineralizer vessel in a condensate water demineralization system.

10 14. A performance evaluation apparatus for anion exchange resins, comprising:

an outlet monitoring device for measuring the inorganic carbonic acid concentration of the outlet water of an ion exchange resin vessel filled with an anion exchange resin; and

15 an evaluation device for evaluating the performance of the anion exchange resin filling said ion exchange resin vessel based on the measurement value of the inorganic carbonic acid concentration of the outlet water obtained from said monitoring device.

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15. An apparatus according to claim 14, further comprising:

an inlet monitoring device for measuring inorganic carbonic acid concentration of the inlet water of said ion exchange resin vessel; wherein

25 said evaluation device evaluates the performance of said

anion exchange resin based on the inorganic carbonic acid concentrations of said outlet water and of said inlet water.

16. An apparatus according to claim 14, wherein said outlet  
5 monitoring apparatus continuously measures the inorganic carbonic acid concentration of said outlet water.

17. An apparatus according to claim 14, wherein said outlet  
10 monitoring apparatus intermittently measures the inorganic carbonic acid concentration of said outlet water.

18. An apparatus according to claim 15, wherein said evaluation  
apparatus calculates MTC (Mass Transfer Coefficient) of said anion  
exchange resin with respect to the inorganic carbonic acid from  
15 the measurement values of the inorganic carbonic acid concentrations of the inlet water and of the outlet water of said ion exchange resin vessel, and evaluates the performance of the anion exchange resin based on the obtained MTC.

20 19. An apparatus according to claim 18 wherein said evaluation apparatus evaluates the degree of degradation of the anion exchange resin from said MTC and judges at least one of replacement timing, lifetime, and throughput capacity for said anion exchange resin.

25 20. An apparatus according to claim 14 wherein said ion exchange

resin vessel is a condensate water demineralization vessel of a condensate water demineralization system.

21. An apparatus for evaluating the performance of an anion  
5 exchange resin filling an ion exchange resin vessel, comprising:

10 a mini-column filled with the same anion exchange resin as the anion exchange resin of said ion exchange resin vessel and having the height of the layer of the anion exchange resin lower than the height of the layer of the anion exchange resin filling said ion exchange resin vessel;

15 a monitoring device for passing a portion of the inlet water of said ion exchange resin vessel from the inlet of said mini-column and measuring inorganic carbonic acid concentration of the outlet water of said mini-column; and

an evaluation device for evaluating the performance of the  
anion exchange resin filling said ion exchange resin vessel based  
on the obtained measurement value of the inorganic carbonic acid  
concentration of the outlet water of said mini-column.

20 22. An apparatus for evaluating the performance of an anion exchange resin filling an ion exchange resin column, comprising:

25 a mini-column filled with the same anion exchange resin as the anion exchange resin of said ion exchange resin vessel and having the height of the layer of the anion exchange resin lower than the height of the layer of the anion exchange resin filling said ion

exchange resin vessel;

a monitoring device for passing a portion of the inlet water of said ion exchange resin vessel from the inlet of said mini-column and measuring inorganic carbonic acid concentrations of the inlet water and of the outlet water of said mini-column; and

an evaluation device for evaluating the performance of the anion exchange resin filling said ion exchange resin vessel based on the obtained measurement values of the inorganic carbonic acid concentrations of the inlet water and of the outlet water of said mini-column.